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Magnitude of o *Ceti* (*Mira*), 1906 *December* 14–1907 *February* 16, *as observed at the Radcliffe Observatory, Oxford.*

(*Communicated by the Radcliffe Observer.*)

Information having been received early in December that the increase in the light of Mira Ceti suggested a maximum of abnormal brightness, observations of this variable were undertaken by Mr Wickham and Mr Robinson.

These observations are made by Argelander's method, and are all naked-eye estimations.

When the observations commenced the variable had already considerably exceeded its brightness on the occasion of the last maximum, but a curve drawn to represent the observed magnitudes does not clearly indicate a maximum, the epoch of which may have occurred previous to December 14. Unfortunately, observations were rendered impracticable on December 11–13 by bad weather which prevailed. The date of maximum derived from Chandler's "Revision of Elements of Third Catalogue of Variable Stars" (*A. J.* 553) is 1906 December 19.*

The variable was so bright on the earlier nights that it was necessary to take comparison-stars situated at considerable distances from it, and at various altitudes, but these are distributed in such a way that the resulting mean will, it is hoped, be fairly free from the effects of atmospheric absorption. The proximity of α Ceti, the colour of which was similar to that of the variable, was found advantageous, but the observers met with the usual difficulty in comparing the dull yellow light of the variable with that of lustrous white stars.

Some notes on colour are included amongst the "Observers' Remarks."

It is worth mentioning that in the *Harvard Annals, Photometry*, vol. xiv. p. 121, α Ceti is described as "O," or pronounced orange, whilst in the recently published vol. xvii. of the Potsdam Astrophysical Observatory this star is characterised as "G—," or between light yellow and yellow.

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* It may be well to point out here that the second term of the periodic inequality as given in the footnote to the catalogue is incorrectly printed. The coefficient should be 12·3 (not $12^{\mathrm{m}}{\cdot}3$), the unit being a day.

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TABLE I.

Stars used for Comparison.

Ref. No.	Name of Star.	R.A. 1900.	N.P.D. 1900.	Adopted Mag.	Ref. No.	Name of Star.	R.A. 1900.	N.P.D. 1900.	Adopted Mag.
		h m	° ′				h m	° ′	
1	α Androm.	0 3·2	61 28	2·15	20	α Persei	3 17·2	40 30	1·90
2	γ Pegasi	0 8·1	75 22	2·87	21	ε Eridani	3 28·2	99 48	3·82
3	β Ceti	0 38·6	108 32	2·26	22	δ Eridani	3 38·5	100 6	3·72
4	γ Cassiop.	0 50·7	29 49	2·25	23	γ Eridani	3 53·4	103 48	3·27
5	η Ceti	1 3·6	100 43	3·61	24	Aldebaran	4 30·2	73 41	1·06
6	β Androm.	1 4·1	54 55	2·37	25	ι Aurigæ	4 50·5	57 0	2·86
7	θ Ceti	1 19·0	98 42	3·83	26	β Eridani	5 2·9	95 13	2·87
8	η Piscium	1 26·1	75 10	3·71	27	Rigel	5 9·7	98 19	0·34
9	β Arietis	1 49·1	69 41	2·73	28	γ Orionis	5 19·8	83 44	1·70
10	α Piscium	1 56·9	87 43	3·94	29	β Tauri	5 20·0	61 29	1·78
11	γ Androm.	1 57·8	48 9	2·20	30	δ Orionis	5 26·9	90 22	2·48
12	α Arietis	2 1·5	67 1	2·23	31	ε Orionis	5 31·1	91 16	1·68
13	ξ^2 Ceti	2 22·8	81 59	4·34	32	ζ Orionis	5 35·7	92 0	1·89
14	δ Ceti	2 34·4	90 6	4·00	33	κ Orionis	5 43·0	99 42	2·18
15	γ Ceti	2 38·1	87 11	3·58	34	α Orionis	5 49·8	82 37	0·93
16	η Eridani	2 51·5	99 18	4·06	35	β Aurigæ	5 52·2	45 4	2·07
17	α Ceti	2 57·1	86 18	2·82	36	γ Cygni	20 18·6	50 4	2·32
18	Algol (β Pers.)	3 1·7	49 26	2·31	37	β Pegasi	22 58·9	62 28	2·61
19	ζ Eridani	3 11·0	99 11	4·88	38	α Pegasi	22 59·8	75 20	2·57

The adopted magnitudes are the means of all values found in the following *Harvard Annals* :—

1. "Harvard Photometry" (vol. xiv.).
2. "Photometric Revision of the D.M." (vol. xxiv.).
3. "Miscellaneous Photometric Measurements" (vol. xxiv.).
4. "Photometric Revision of the Harvard Photometry" (vol. xliv.).
5. "A Photometric D.M." (vol. xlv.).

TABLE II.

Observations of the Magnitude of o Ceti (Mira).

Day and Hour.		Obsr.	Estimations.	Resulting Magnitude.
1906.	h			
Dec. 14	7	R	·2 f 29 ; ·1 b 12 ; ·4 b 17 ; = 3	2·19
14	9¼	W	much f 24, 30, 31, 32, 35 ; much b 10	...
21	8½	W	= 18 ; = 11 ; ·5 f 12 ; ·33 b 17 ; ·67 f 35 ; ·5 f 30, 31, 32 ; 1·5 b 10 ; much f 24	2·50
26	6¼	R	·2 f 29 ; ·2 f 12 ; ·2 f 3 ; ·7 b 17 ; ·7 b 9	2·18

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TABLE II.—*continued.*

Observations of the Magnitude of ο Ceti (Mira).

Day and Hour.		Obsr.	Estimations.	Resulting Magnitude.
1906.	h			
Dec. 26	8½	W	·5 f 12 ; ·25 b 30 ; ·25 f 31 ; ·25 f 32 ; = 11 ; much f 24, 27, 34	2·25
27	8½	W	·2 f 12 ; ·5 b 17 ; = 31, 32 ; ·3 b 30 ; ·2 b 11	2·06
27	8½	R	= 12 ; ·2 f 1 ; ·3 b 38 ; ·7 b 37 ; ·7 b 17 ; = 38 (2nd obs.)	2·24
1907.				
Jan. 2	6½	R	·2 f 1 ; ·2 f 12 ; ·6 b 9 ; ·4 b 17 ; ·4 f 29	2·30
3	6	R	·3 b 17 ; ·4 b 38 ; ·1 f 37 ; ·6 b 9 ; ·3 f 1 ; ·3 f 12 ; ·6 b 2	2·40
3	6¼	W	·3 f 1 ; = 6, 11, 12, 36 ; ·4 b 17 ; ·3 f 20 ; ·2 f 35	2·31
6	8¼	R	·3 b 17 ; ·3 f 12 ; ·6 b 9 ; ·3 f 6	2·46
6	8⅓	W	·5 f 28 ; ·4 f 12 ; ·3 b 9 ; ·3 f 20 ; ·25 b 17 ; ·3 f 36, 35 ; ·2 f 29, 30 ; ·1 b 4 ; = 33 ; ½ (1 + 2)	2·39
11	6	R	·5 b 9 ; ·5 f 12 ; ·1 b 17	2·56
11	7	W	·4 f 12 ; ·2 b 9 ; ·3 f 6 ; ·2 b 17 ; ·2 f 32 ; ·2 b 25	2·53
17	8	W	= 17 ; ½ (9 + 12)	2·59
17	8½	R	·25 b 9 ; ·3 f 17 ; ·5 b 2 ; ·4 f 33 ; ·4 b 26 ; ·5 b 23	2·63
18	7	R	·15 f 17 ; ·2 b 9 ; ·3 b 2 ; ·4 b 26 ; ·2 f 30	2·64
22	7	R	·4 f 17 ; ·3 b 23 ; ·2 b 26 ; ·4 f 33 ; ·8 b 5 ; ·9 b 7 ; 1·0 b 15 ; ·4 f 30 ; ·15 b 2	2·82
23	6½	R	·2 b 26 ; ·4 f 33 ; ·4 f 17	2·82
29	7	R	= 26 ; ·5 f 17 ; ·45 b 15 ; ·2 f 9 ; ·1 f 23 ; ·7 f 33 ; ·1 f 2 ; ·8 b 10	3·08
31	6¾	R	·2 f 23 ; ·2 b 15 ; ·6 f 17 ; ·3 b 10 ; = 26 ; ·45 f 2 ; ·55 f 9 ; ·3 b 22 ; ·4 b 21 ; ·4 b 14	3·38
Feb. 2	6¾	R	·7 f 17 ; ·25 b 15 ; ·5 b 14, 10 ; ·4 b 16, 21 ; ·4 f 23, 2 ; ·15 b 22 ; ·5 f 9 ; ·2 f 26 ; ·3 b 8	3·42
2	7	W	1·0 f 17 ; ½ (14 + 17)	3·55
10	8	R	= 16, 21 ; ·2 b 14 ; ·1 b 10	3·88
13	7	R	·1 f 14 ; ·2 f 10 ; ·2 b 13 ; ·6 b 19 ; ·2 f 16, 21	4·16
16	7	R	much f 14 ; estimated mag.	4·50

Observers' Remarks.

1906. Dec. 14. Half weight to comparison with No. 3. Colour of Mira a mean tint between the pale yellow of Capella and the deep orange of Aldebaran. (R.)

(With small telescope, aperture 1¾-inch, the image of the variable showed distinct carmine fringes, which were not visible in the comparison stars, with two exceptions, α Ceti and Aldebaran, where the colour and fringes were much fainter. [W.])

Dec. 21, 27. The dull yellow colour of the variable and some

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of the comparison stars is obvious to the naked eye, and comparison with brilliant white stars, such as those of the belt of Orion, is difficult. (W.)

Dec. 26. Observations rather difficult owing to the proximity of the Moon. Slight haze at times. Half weight to comparison with No. 3. (R.)

Dec. 27. Mira similar in colour to α Arietis, yellow. (R.) Half weight to comparison with No. 17. (W.)

1907. Jan. 2. Colour of ο Ceti similar to that of α Arietis. (R.)

Jan. 3. α Ceti is reddish; ο Ceti is yellow, closely resembling α Arietis in colour. (R.)

Jan. 6. Colour of ο Ceti same as α Arietis, but α Ceti and β Androm. are orange-red. (R.) The yellow colour of Mira is still manifest to the naked eye. (W.)

Jan. 11. α Ceti reddish; α Arietis and ο Ceti yellow. (R.)

(W. and R. examined Mira Ceti with the Barclay Equatorial, aperture 10-inch, power 88. Both observers noted that the image of Mira showed markedly red spiculæ around the margin, but this margin was not so broad nor so deep a red as the same observers saw around Nova Persei in 1901. Two other coloured stars were examined for comparison. α Ceti exhibited but little red in its fringe, whilst a light orange or canary colour prevailed over the main image. Aldebaran showed reddish orange with a narrow margin of red, but this of a light tint only. The image of Mira Ceti was therefore quite distinct in appearance from these stars when viewed with the same optical means.

Observer R. notes, in addition, that "with the naked eye Mira is not so deep an orange as α Ceti, but with the Barclay telescope it is decidedly deeper than α and not quite so bright.")

Jan. 17. Sky itself transparently clear, but a ground fog prevailed, diminishing from the horizon towards Cetus, but even there it obscured all stars of the fifth magnitude. (W.)

The fog seemed to render stars of an orange colour more conspicuous to-night; α Ceti was, probably from this cause, relatively brighter than usual. The observations were made from the summit of the Observatory tower, 100 feet above the ground. (R.)

Jan. 18. Foggy; estimations difficult; but probably the mean is reliable. The observations were made from the summit of the Observatory tower. (R.)

Jan. 22. Bright Moon effectually screened during the observations. (R.)

Jan. 23. A brief comparison only. (R.)

Jan. 29. Observed in intervals of cloud and in bright moonlight. Estimations rather difficult, but mean is reliable. (R.)

Jan. 31. Sky hazy; observation difficult. (R.)

Feb. 16. Seen with difficulty in moonlight and through low haze. (R.)

Radcliffe Observatory, Oxford:
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Early and Late Perseids. By W. F. Denning.

The following is a list of the apparent paths of probable and possible Perseids observed at Bristol during the 16 nights July 7 to 22 and 9 nights August 17 to 25 inclusive in the thirty years from 1876 to the present time. A proportion of these meteors were undoubtedly not true Perseids, but belonged to the other showers existing in Cassiopeia, Andromeda, Pisces, Aries, Camelopardus, Taurus, Auriga, etc., at the same epoch. There are a great number of such radiants visible—certainly more than a hundred—and it is very difficult to attribute correct positions for some of the individual meteors which have appeared at this time of the year.

The materials here furnished may afford some help in determining the dates of beginning and ending of the Perseid shower. These are very doubtful at present, but I believe that the weight of evidence favours the conclusion that true Perseids may be occasionally recognised after the first week in July. The display is very feeble at that time, and may not supply one meteor during a watch of several hours by a single observer. But on July 19 the stream becomes well pronounced, and its radiant capable of being definitely ascertained, though not in every year. The date just mentioned is in fact the earliest one on which I can confidently say that Perseid meteors are sometimes visible in sufficient numbers to enable a good radiant to be obtained by an individual observer.

In the last column of the list I have ascribed the radiants as they appear in my MS. book of observations. These positions are not correct in all cases. But I have reprojected the apparent paths, and have affixed the letter P to distinguish those which may be regarded as Perseids.

If other observers will supply similar data it will be possible to deduce the place of the radiant on every night from July 7 to 22. But it cannot be safely said that the shower begins so early as July 7; it will be very difficult to learn when the earth really encounters the first shots from this widely-distended stream.

Further materials for the above period, and for the concluding stages from August 17 to 25, will throw an interesting light on the actual duration of the shower, and on the positions of the radiant near the limiting dates of its visibility.

We might soon determine these features but for the fact that there are many other secondary displays yielding similar meteors and radiating from the same region of the sky. It is often impossible to say whether meteors are Perseids or not, though their flight-directions may conform with the position of the great August shower. At the earlier stages of the display there are well-defined minor radiants at about

° °	° °	° °
23+43	33+52	50+31
23+57	43+22	54+71
29+36	44+57	60+58
33+18	47+43	61+48

—and many others, varying in strength from year to year.